CLAIM LISTING

This listing of claims will replace all prior versions, and listings of claims in the application:

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of processing data of a data communication channel, comprising:

receiving a plurality of serial data signals from lanes of the communication channel;

de-multiplexing serial data from each of the serial data signals received from the lanes and formatting the serial data ~~of the lanes~~ into parallel data;

checking the parallel data for a start-of-frame (SOF) character;

responsive to detecting ~~the checking for~~ a the SOF character, parsing the parallel data into invalid data ~~non-data~~ and valid ~~real~~ data, wherein valid data does not include control characters;

basing the parsing of the parallel data at least in part on placement relative to the SOF character;

packing the parsed valid ~~real~~ data into a group of data;

presenting the packed group of data; and

activating an SOF ~~start-of-frame~~ sideband signal when beginning the presenting of the packed group of data;

the SOF sideband signal being separate signaling from the packed group of data and presented in association with the packed group of data for sideband encapsulation.

2. (Currently Amended) The method of claim 1, further comprising:

checking the parallel data for an end-of-frame (EOF) character;

the parsing the parallel data to include ~~comprise~~:

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determining if a character of the parallel data is outside a frame bounded by the SOF character and the EOF character[[s,]]; and

if the character is determined to be outside the frame, defining the character as non-data being part of the invalid data.

3. (Currently Amended) The method of claim 2, wherein the parsing further includes defining to define the SOF character and the EOF character[[s]] as being part of the invalid data non-data.

4. (Currently Amended) The method of claim 3, wherein the parsing further includes to comprise:

checking for one or more idle characters between the SOF character and the EOF character[[s,]]; and

responsive to detecting the one or more the checking for idle characters between the SOF character and the EOF character, defining the one or more idle characters as part of the invalid data non-data.

5. (Currently Amended) The method of claim 2, wherein in which the packing configures the valid real data into a contiguous group.

6. (Currently Amended) The method of claim 5, further comprising activating an EOF end-of-frame sideband signal when sending out a last portion of the contiguous group.

7. (Currently Amended) The method of claim 6, wherein in which the packing comprises aligning the real valid data of the contiguous group with one of a left alignment or a right alignment relative to at least one of the SOF sideband signal and the EOF sideband signal[[s]].

8. (Currently Amended) The method of claim 2, wherein: in which

the receiving comprises receiving sequential words each having a byte width proportional to ~~the~~ number of the lanes;

the checking for the EOF character comprises:

examining bytes in an initial ~~a first~~ word including the SOF character; and if the EOF character is not found in the initial word, the method further comprising repeating for subsequent words the receiving, de-multiplexing, parsing and packing at least until finding the ~~an~~ EOF character.

9. (Currently Amended) The method of claim 8, wherein characters forming the words have a ~~in which the received sequential words comprise characters of~~ left to right relationship corresponding to time-ordered placement of the characters.

10. (Currently Amended) The method of claim 8, further comprising performing at least one of storing and outputting the valid data based on ~~the~~ number of the characters thereof previously packed, the amount of the valid ~~new real~~ data packed during the repeating, and ~~the~~ size of the valid data output.

11. (Currently Amended) The method of claim 10, wherein ~~in which~~ the valid ~~new real~~ data of the repeating is stored when a ~~the~~ total of the valid ~~real~~ data is less than or equal the size of the valid data output, and when the EOF character has not been found.

12. (Currently Amended) The method of claim 11, wherein ~~in which~~ a portion of the valid ~~new real~~ data of the repeating is output together with the valid data previously packed ~~data~~, and a remaining portion of the valid ~~new real~~ data of the repeating is stored when the total ~~real data~~ exceeds the size of the valid data output.

13. (Currently Amended) The method of claim 11, wherein ~~in which~~ the valid data packed ~~data~~ is output when the ~~an~~ EOF character has been found.

14. (Currently Amended) The method of claim 1, further comprising:

identifying a number of the lanes in the communication channel; and

configuring serial-to-parallel data receivers to receive and de-multiplex the serial data signals of the identified number of the lanes to form output characters for the parallel data.

15. (Currently Amended) A circuit to interface [[a]] communications channel comprising:

a plurality of serial-to-parallel receivers configured to receive serial data signals of data lanes of the communications channel and to recover characters of parallel format from the data lanes;

a plurality of decoders configured to determine character types of the characters recovered by the serial-to-parallel receivers of from the data lanes;

detectors configured to detect at least one of a start-of-frame (SOF) character and an end-of-frame (EOF) character;

a parser configured to parse the characters recovered by the serial-to-parallel receivers based on the character types determined by the decoders and based on placement of the characters relative to a detected the SOF character detected for separating out valid data and invalid data from the characters recovered; and

a packer configured to group the valid data from the parsed characters parsed to provide a valid data group; and

a generator configured to provide the SOF character as a first sideband signal associated with the valid data group for sideband encapsulation.

16. (Currently Amended) The circuit of claim 15, wherein in which the decoders resolve the character types from of the a group consisting of at least one of the SOF character, the EOF character, valid real data characters, and an idle data character[[s]]; and

the parser ~~to~~ invalidate<u>s those of the </u>characters determined to be outside a

frame delineated by at least one of ~~a detected~~ <u>the</u> SOF character and ~~a detected~~ <u>the</u>

EOF character <u>detected</u>.

17. (Currently Amended) The circuit of claim 16, <u>wherein</u> ~~in which~~ the packer is

<u>configured</u> ~~operable~~ to pack ~~decoded~~ <u>the valid</u> ~~real~~ data characters of the characters

determined <u>to be</u> inside the frame <u>after being decoded</u>, and to align the ~~packed~~ <u>valid</u>

data characters <u>packed </u>with one of a left ~~of~~ <u>or</u> right alignment<u>; and</u>

 <u>the generator is configured to provide the SOF character as a second sideband</u>

<u>signal associated with the valid data group for the sideband encapsulation</u>.

18. (Currently Amended) The circuit of claim 17, <u>wherein</u> the parser and the packer

further ~~to~~ group the ~~packed~~ <u>valid</u> data characters <u>packed</u> into a contiguous block, the

contiguous block <u>not </u>having ~~no~~ <u>any said </u>idle character[[s]] between <u>the valid</u> ~~real~~ data

characters.

19. (Currently Amended) The circuit of claim 17, further comprising:

 storage registers accessible to store characters for subsequent retrieval; and

 a storage controller to transfer the ~~aligned~~ <u>valid</u> data characters <u>aligned</u> to the

storage registers if the detectors determine absence of ~~an~~ <u>the </u>EOF character.

20. (Currently Amended) The circuit of claim 19, further comprising:

 a data output port having a word width; ~~and~~

 ~~in which~~ the storage controller <u>configured</u> ~~is further operable~~ to determine a first

amount of the ~~aligned~~ <u>valid</u> data characters <u>aligned and [[,]]</u> a second amount of <u>the</u>

<u>valid</u> data characters <u>stored</u> ~~retained~~ in the storage registers[[,]] <u>;</u> and

 <u>the storage controller further configured for comparing</u> [[if]] a total of the first

amount and <u>the</u> second amount[[s]] to ~~is greater than ~~the word width of the <u>data</u> output

port[[,]]<u>, a first result of the comparing being that the total is greater than the word</u>

width and a second result of the comparing being the total is at least equal to the word width; and

responsive to the first result, the storage controller configured to transfer at least a portion of the ~~aligned~~ valid data characters aligned to the storage registers.

21. (Currently Amended) The circuit ~~according to~~ of claim 20, further comprising an output controller configured to enable transfer of the valid data characters to the data output port responsive to ~~at least one of~~ the detector detecting ~~an~~ the EOF character, responsive to the second result, or responsive to both the detector detecting ~~an~~ the EOF character and the second result ~~and the storage controller determining that the total is at least equal to the word width of the output port~~.

22. (Currently Amended) The circuit of 21, wherein ~~in which~~ the storage controller and the output controller are further configured ~~operable~~, responsive to ~~determining the total is greater than the word width of the output port~~ the first result, to take characters from the storage registers and a first portion of the ~~aligned~~ valid data characters to form and present an output word on the data output port.

23. (Currently Amended) The circuit of 22, wherein ~~in which~~ the storage controller and the output controller are further configured ~~operable~~ to write a remaining portion of the ~~aligned real~~ valid data characters aligned into the storage registers.

24. (Currently Amended) A system to interface with a communication channel having a plurality of serial data lanes, comprising:

a ~~plurality of~~ receivers to receive ~~the~~ serial data from the serial data lanes, each receiver of the receivers including ~~comprising~~ a serial-to-parallel converter to convert ~~received~~ the serial data received to a parallel format;

the ~~plurality of~~ receivers providing ~~comprising~~ outputs that collectively form a word having a width related to ~~the~~ a total number of the serial data lanes;

decoders configured to identify character types recovered by the receivers;

logic configured to determine when a decoder of the decoders has identified at

least one of the character types of a the group consisting of a start-of-frame (SOF)

character and an end-of-frame (EOF) character;

parsing circuitry configured to parse determine valid characters of the word

based upon placement relative to the at least one of the character types identified

start-of-frame character and the end-of-frame character;

[[a]] storage registers selectively operable to store receive the valid characters

that have been determined valid by the parser; and

a controller to control presentment of the valid characters parsed determined as

valid data to at least one of the storage registers and [[or]] an output port, the

presentment of the valid characters based on the character types identified by the

decoders, the placements of the relative the SOF character, a first amount of the valid

characters parsed determined by the parsing circuitry, and a second amount of the

valid characters stored in the storage registers; and

a generator configured to provide a first sideband signal associated with the

valid data for output as sideband encapsulated, the first sideband signal being

responsive to the SOF character.

25. (Currently Amended) The system of claim 24, further comprising a wherein the

generator is configured to present the first [[a]] sideband signal as a sideband start-of-

frame (SOF) signal to accompany the valid data at the output port when first

presented.

26. (Currently Amended) The system of claim 25, wherein the generator is further

configured to present a second sideband signal as a sideband end-of-frame (EOF)

signal to accompany parsed the valid data parsed at the output port when a decoder of

the decoders and the logic have determined an EOF character and the controller has

enabled presentment of a word of the valid data of a word associated with the EOF

character.

27. (Currently Amended) The system of claim 26, wherein the generator is [[to]] further configured to present a data valid signal when the ~~parsed~~ valid data parsed and the second ~~accompanying EOF~~ sideband signal are presented at the output port.

28. (Currently Amended) The system of claim 24, wherein the logic is further ~~operable~~ configured to determine when a decoder ~~which~~ of the decoders has ~~have~~ identified valid ~~real-data~~ character types and when the decoder has ~~those that have~~ identified idle character types.

29. (Currently Amended) The system of claim 28, further comprising alignment circuitry configured to align the valid ~~real-data~~ characters into a contiguous block with one of a left alignment as associated with the SOF character or a right alignment as associated with ~~relative to a delineated between the SOF and~~ the EOF character[[s]].

30. (Currently Amended) The system of claim 29, wherein ~~in which~~ the controller is further configured ~~operable~~ to store a first portion of the ~~aligned data~~ valid characters aligned in the storage registers when a ~~the~~ total ~~of the amount~~ of the valid characters aligned ~~characters~~ combined with ~~and the amount of~~ the characters in the storage register is less than or equal to the width of the output port.

31. (Currently Amended) The system of claim 30, wherein ~~in which~~ the controller is further configured ~~operable~~ to store a remaining portion of the ~~aligned data~~ valid characters aligned in the storage register when the total exceeds the width of the output port.

32. (Currently Amended) The system of claim 30, wherein ~~in which~~ the controller is operable to output the ~~stored~~ characters stored in [[of]] the storage registers responsive to ~~the decoders and~~ the logic determining that a decoder of the decoders has identified the [[an]] EOF character.

33. (Currently Amended) The system of claim 28, <u>wherein:</u> ~~in which~~

at least a portion of the receivers, the decoders, the logic, the parsing circuitry, the storage registers, and the controller comprise devices embedded within a programmable logic device; and

another portion thereof comprise configured programmable resources of the programmable logic device.

34. (Currently Amended) The system of claim 33, <u>wherein</u> ~~in which~~ the programmable logic device comprises configuration memory programmed with configuration data operable to configure the programmable resources adaptive to the <u>total</u> number of <u>the</u> serial data lanes ~~of the communication channel~~.

35. (Currently Amended) The system of claim 33, <u>wherein</u> ~~in which~~ the decoders comprise content addressable memories embedded within the programmable logic device and configurable per the programmable resources of the programmable logic device to receive the outputs ~~characters~~ of the receiver<u>s</u> ~~outputs~~ and to source decode information to the logic.

36. (Currently Amended) A circuit to interface to a communications channel comprising:

means for receiving data signals from data lanes of <u>the</u> [[a]] communication channel;

de-multiplexing means for recovering serial data from the data signals and converting the serial data into parallel data;

decode means for decoding characters recovered by the de-multiplexing means;

detection means for detecting ~~at least one of~~ a start-of-frame (SOF) character and an end-of-frame (EOF) character;

parser means for parsing characters based upon type decoded and placement relative to <u>the</u> [[a]] SOF character; ~~and~~

grouping means for grouping together ~~parsed~~ the characters parsed; and

means for generating a sideband signal for output with the characters parsed, the sideband signal generated responsive to the SOF character for sideband encapsulation.

37. (Currently Amended) The circuit of claim 36, wherein ~~in which~~ the decode means resolves character types of a ~~the~~ group consisting of at least one of the SOF character, the EOF character, valid data characters, ~~real data~~ and idle data characters; and

the parser means further bases the parsing upon whether the character placement is outside a frame delineated by at least one of the ~~a detected~~ SOF character and the ~~a detected~~ EOF character.

38. (Currently Amended) The circuit of claim 37, wherein ~~in which~~ the grouping means groups ~~real~~ valid data characters parsed inside the frame into a contiguous block with one of a left alignment as associated with the SOF character or a right alignment as associated with the EOF character ~~determined inside the frame with one of a left of right alignment~~.

39. (Currently Amended) The circuit of claim 38, wherein the ~~parser means and the grouping means to group the data characters into a~~ contiguous block has ~~having~~ no idle characters.